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REMARKS

Claims 1 to 4, 7, 8 and 11 to 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Katoh et al. (U.S. Patent No. 5,402,641; hereinafter "Katoh") in view of Leyrer et al. (U.S. Patent No. 5,643,542; hereinafter "Leyrer"). Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Katoh in view of Leyrer as applied to claim 1, and further in view of legal precedent.

Initially, it is noted that the Office takes the position that although Katoh is directed to a method for purifying exhaust gas from lean burning internal combustion engines and does not disclose applying the method to a gasoline fuel-direct-injection type engine, it would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Katoh to a gasoline fuel-direct-injection type engine, "since the recitation of such amounts to an intended use statement." (Action, page 3, line 2 from the bottom of the page).

The Office is wrong. The recitation in claim 1 of the step of "purifying exhaust gas from a gasoline engine of a fuel-direct-injection type by contacting said exhaust gas with the exhaust-gas purifying-use catalyst" is a positive limitation that limits the invention to a process for purifying exhaust gas from a gasoline

engine of a fuel-direct-injection type. Therefore, to support its case of obviousness under 35 U.S.C. § 103(a), the Office must show that the prior art provides a motivation, suggestion or teaching to apply the method of Katoh to an engine of a fuel-direct-injection type and to otherwise modify the method of Katoh as required to obtain the method of the present invention.

Referring now to the rejections in the Action, the feature of the method according to claim 1 of the present application is that, for purifying a first exhaust gas produced by a gasoline engine of fuel-direct-injection type under a driving condition at which an air-fuel ratio is stoichiometric and a second exhaust gas produced by the gasoline engine under a driving condition at which an air-fuel ratio is one at lean burn mode, the gasoline engine is controlled such that the use of an exhaust gas purifying-use catalyst capable of purifying the first exhaust gas allows the temperature at the inlet of the catalyst to be low, i.e., equal to or lower than a predetermined temperature even at a second exhaust gas state.

With this feature, the method of the present invention makes it possible that both the first exhaust gas and the second exhaust gas are purified by using only one exhaust gas purifying-use catalyst. This allows simplification in purifying the

exhaust gases respectively produced under the driving conditions by the gasoline engine of the fuel-direct-injection type.

The invention of Katoh, as noted by the Office, is limited to a process for purifying exhaust gas of a lean burn engine. Katoh does not disclose, suggest, teach or otherwise provide a motive to a person of ordinary skill in the art to apply its method to purifying exhaust gas of a gasoline engine of a fuel-direct-injection type.

First, Katoh describes that a three-way catalyst cannot purify NO_x in exhaust gas under lean burn (see column 1, lines 15 to 24). The three-way catalyst refers to a catalyst whose composition mainly consists of platinum (Pt), rhodium (Rh), and cerium oxide (CeO_2). This composition is well known to a person with ordinary skills in the art.

In the invention of Katoh, an NO_x absorbent is used which absorbs NO_x under lean burn. When an oxygen concentration of the exhaust gas decreases after the NO_x absorbent absorbs NO_x, the NO_x thus absorbed is released (see column 3, lines 52 to 60). The decrease of the oxygen concentration of the exhaust gas occurs when hydrocarbon and CO are increased in the exhaust gas, i.e., when the air-fuel ratio is changed to the rich air-fuel ratio.

Operation for decreasing the oxygen concentration is described in column 5, lines 6 to 51.

That is, among lean burn engines, Katoh assumes a lean burn engine in which the air-fuel ratio is changed between the lean air-fuel ratio and the rich air-fuel ratio.

The NO_x absorbent disclosed in Katoh contains at least one of alkaline earth, rare earth, and alkali (see claim 1). It is publicly known that cerium is included in rare earth. Specifically, the NO_x absorbent includes Al_2O_3, Pt, Rh, alkali earth, and rare earth (see column 3, lines 61 to 68).

The NO_x absorbent has a composition similar to that of the three-way catalyst. However, unlike a three-way catalyst, the NO_x absorbent absorbs NO_x when exhaust gas is produced at the lean air-fuel ratio, and releases NO_x when exhaust gas is produced at the rich air-fuel ratio.

Katoh describes a further preferable condition under which the three-way catalyst is disposed downstream of the NO_x absorbent (see column 4, lines 4 to 8, Fig. 2, and claim 2).

In Katoh, the three-way catalyst cannot purify NO_x increasing in the exhaust gas produced at the lean air-fuel ratio, so that the NO_x absorbent absorbs the NO_x. In order to avoid SOx poisoning in the NO_x absorbent upon the absorption, the

air-fuel ratio is alternately switched between the lean air-fuel ratio and the rich air-fuel ratio for a short period of time. Specifically, the air-fuel ratio is alternately switched under such conditions that a period during which the air-fuel ratio is the lean air-fuel ratio continues for 2 minutes and then a period during which the air-fuel ratio is the rich air-fuel ratio continues for 0.5 second to 3 seconds. In this case, the temperature of the exhaust gas produced at the lean air-fuel ratio is 550 °C or higher, and the temperature of the inlet of the NO_x absorbent is 500 °C or higher.

However, Katoh neither discloses nor suggests a gasoline engine of fuel-direct-injection type, which is required in current claim 1 of the present application. Moreover, Katoh neither discloses nor suggests the preferable process described in current claim 1 of the present application, i.e., the process for purifying the second exhaust gas (inclusive of NO_x) produced at a lean air-fuel ratio, by using a catalyst capable of purifying the first exhaust gas produced at the stoichiometric air-fuel ratio.

Leyrer does not overcome the insufficiencies of Katoh. Leyrer discloses a catalyst which is capable of purifying hydrocarbon, CO, and NO_x of exhaust gas including excess oxygen

and in which a metal of platinum group is contained in an aluminum silicate having a high surface area. The aluminum silicate is one type of zeolite.

ZSM-5 described in comparative example of the specification of the present application is a synthetic zeolite and is usable for purifying exhaust gas. From Tables 1 and 2 indicating the results of examples and comparative examples described in the specification of the present application, it is apparent that the catalyst of the present invention is more effective than ZSM-5.

Moreover, the invention of current claim 1 of the present application exhibits an unpredictable and notable effect as compared with Leyrer. That is, the catalysts of Examples 1 to 37 of Leyrer allow an NO_x conversion rate falling within a range from 9 % to 60 %, as shown in Table 5 of column 14. On the other hand, the NO_x purifying rate in the present invention is 90 % as shown in Table 1 of the specification of the present application. As such, the invention of the present application exhibits an apparently better effect as compared with Leyrer.

The invention described in current claim 1 of the present application includes a step new to the combination of Katoh and Leyrer which is that when the exhaust gas purifying-use catalyst prepared to purify the first exhaust gas produced under a driving

condition at which the air-fuel ratio is stoichiometric and including at least one noble metal of platinum and iridium is used to purify the second exhaust gas which causes an oxidizing atmosphere as compared with the first exhaust gas state in which the temperature at the inlet of the catalyst is in the range from 350 °C to 800 °C, the second exhaust gas state is controlled such that the temperature at the inlet of the catalyst falls within the range from 200 °C to 350 °C, which is lower than the range of the temperature in the first exhaust gas state.

The invention described in current claim 1 of the present application allows the NO_x purifying rate to be 90 %, which is unpredictably excellent as compared with the purifying rate reasonably expected from the combination of Katoh and Leyrer.

As such, as compared with the combination of Katoh and Leyrer, the invention described in current claim 1 of the present application includes a new step, which allows the unpredictable excellent effect.

Removal of the 35 U.S.C. 103(a) rejections of the claims is believed to be in order and is respectfully requested.

The foregoing is believed to be a complete and proper response to the Office Action dated January 29, 2007, and is believed to place this application in condition for allowance.

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If, however, minor issues remain that can be resolved by means of a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number indicated below.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension may be charged to our Deposit Account No. 111833.

In the event any additional fees are required, please also charge our Deposit Account No. 111833.

Respectfully submitted,

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PAGE 10/10 * RCVD AT 4/30/2007 5:10:05 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/15 * DNIS:2738300 * CSID:202 887 0018 * DURATION (mm-ss):02-04